MASTER DE PHYSIQUE ET APPLICATIONS - 2ème année
**Spécialité Sciences des Matériaux et Nano-objets**
**International Nanomat Master Program**

## Internship proposal 2008-2009


**Laboratory : Institut des Nanosciences de Paris**

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# Coherent control in a single semiconductor nanostructure

**Scientific project :**

**The important improvements in growth techniques during the last decades allowed to realize very well controlled nanostructures. The electronic properties are fundamentally changed due to the confinement and can illustrate perfectly the quantum properties of matter. New experimental techniques have also been developed in order to observe these nanostructures. We have realized in our team a microphotoluminescence experiment which allows to perform spectroscopy with high spatial resolution of a single nanostructure inside a statistical distribution. This allows also to study in a controlled manner the interactions between nanostructures and their environment and get a better insight in the structural disorder. During the internship, we propose to study the electronic and optical intrinsic properties of semiconducting nanostructures like quantum wires or quantum dots. We are mostly interested in the non-linear light-matter coupling in a single quantum dot (Rabi oscillations) and in the coherence properties of the prepared quantum states. The spectroscopic experiments are realized in an waveguiding configuration where the quantum dots are embedded in an optical waveguide. The one-dimensional confinement of light has an important effect on the radiative recombination properties of the quantum dots. The aim of this research is to prepare, manipulate and control the quantum state during its coherence time by means of coherent control experiments. Such a realization consists a key tool for an eventual quantum information process using as quantum bits the two-level systems formed by excitonic levels in a single quantum dot.**

**Techniques in use :**
**High spatial resolution spectroscopy (microphotoluminescence)**
**Ultrafast optics (picosecond domain)**
**Cryogenics**

**Applicant skills :**

**Granted internship : yes ( 380€/month)**
**C'nano IdF laboratory (France only) : yes**
**Possibility for a thesis : yes (type of grant: French research ministry, C'Nano)**